Some Notes on the Reproduction, Metamorphosis, and the Ecology of a Ceylonese Tree Frog *Rhacophorus cruciger cruciger* (Blyth)

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(*With two plates and one text photo*)

INTRODUCTION

Considerable work has been done on the taxonomy and distribution of the amphibia peculiar to Ceylon, but our knowledge of their life histories and ecology is extremely meagre. It was only very recently (Kirtisinghe, 1957) that the tadpoles of *Rana corrugata, R. limnocharis greenii, Rhacophorus c. cruciger, Rh. c. eques,* and *Microhyla zeylanica* were described for the first time, and there are still those of several Ceylonese Anura to be accounted for. The few descriptions that have appeared concerning the purely Ceylonese forms (Günther, 1876; Kirtisinghe, 1957) merely give brief accounts of tadpoles and supply little detailed information of their life histories.

In this paper I have dealt with the breeding, ovulation, 'nest' construction, larval stages, and metamorphosis of *Rhacophorus c. cruciger* (Blyth) and have added some notes on its ecology.

MATERIALS AND METHODS

This work has been based on the observations of over fifty breeding specimens in the field and under laboratory conditions and covers a period of one year. Pituitary gland injections to stimulate breeding activity have not been employed. Conditions under captivity were made, as far as possible, to simulate natural conditions. The duration of metamorphosis as recorded here is given from the observations of a single batch of eggs kept under laboratory conditions. It, however, coincides closely with the duration of metamorphosis observed for three other batches bred in captivity and for a number of batches observed in the natural state.

REPRODUCTION

On the evening of the 25th February 1957, immediately after a shower of rain, three males and two females of *Rhacophorus c. cruciger*

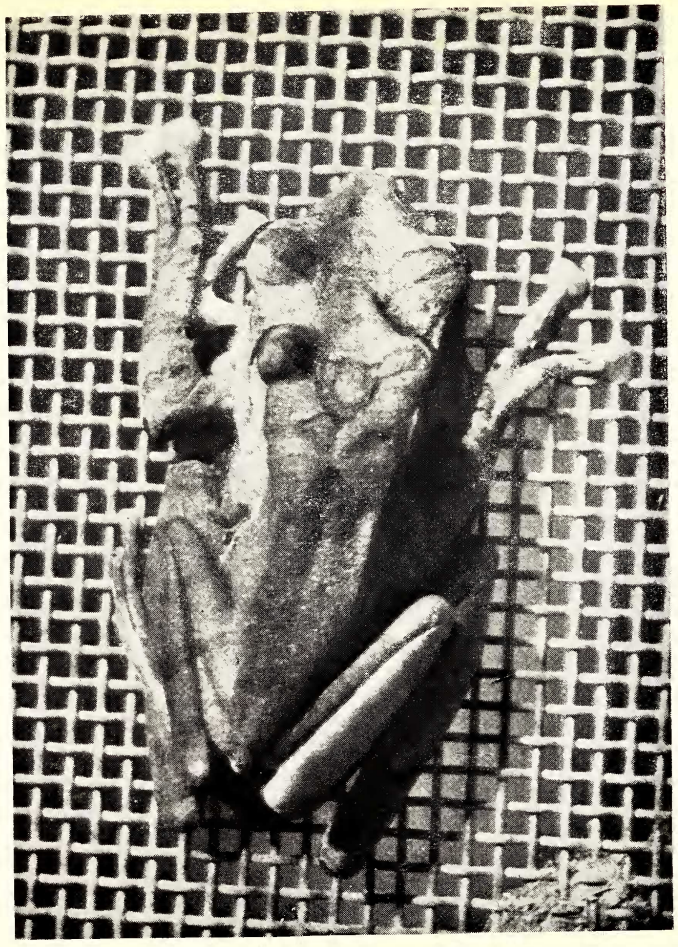
were collected from a small pond near Passara (2,400 ft.). One pair were already in amplexus; the remainder were squatting upon rocks. Two hours later all five animals were placed in a breeding cage and throughout the period, from capture to being placed in their cage, the mated pair did not break from the amplexus though they were handled and carried about in a collecting bag. On a number of similar occasions to separate a pair in this position was comparatively difficult owing to the firm grip taken by the male and his tendency to lash out with his hind legs.

Amplexus in this and eight other cases observed was axillary. Plate I (1) shows an earlier stage where the hands of the male were placed over the shoulders of the female. The final position is shown diagrammatically in Plate I (2) where the thumbs and fingers of the male were clenched and gripped the female firmly immediately behind the arm-pit. At the beginning of amplexus the snout of the male was just aft of a line between the female's eyes, and the vent of the male was about a quarter of an inch forward of the cloaca of the female. The legs of the male were flexed with the feet usually resting upon the thighs of the female.

Observations in the laboratory and field revealed that oviposition, in some thirty instances, took place at night; no cases were recorded during the day. For approximately two hours after being placed in the breeding cage the mating pair continually walked around the sides of their cage (a 4-sided glass aquarium with cement base and wire mesh top, 30″ × 12″ × 9″) not settling down in one position for more than a few minutes. Occasionally they would descend to the bottom of the cage and immerse themselves up to their forelegs in water. On a few occasions they became fully immersed and swam across the cage. Throughout this period preliminary to egg laying the male made spasmodic jerks with his body and legs.

The pair showed no signs of fear at their new and unusual surroundings and finally settled down after some considerable fidgeting of the female's forelegs in order to get a firm grip of the vertical surface of the cage. At 10.10 p.m. the female cocked her thighs and shanks at an angle of approximately ninety degrees to the long axis of the body, her heels touching immediately below and about a quarter of an inch from the cloaca. At the same time the male assumed a similar position taking his feet from the thighs of the female and placing them between his and the female's cloacal opening.

A colourless and sticky liquid was then emitted from the cloaca of the female who immediately commenced to work her feet in a sideways fanning motion from the ankle, thereby working the liquid into a translucent frothy mass which became adherent to the side of the cage. At 10.15 p.m. ova emerged from the cloaca of the female



1. Male and female *Rhacophorus c. cruciger* in early amplexus.

2. Position during egg laying (diagrammatic).

Photos : A. M. Morgan-Davies

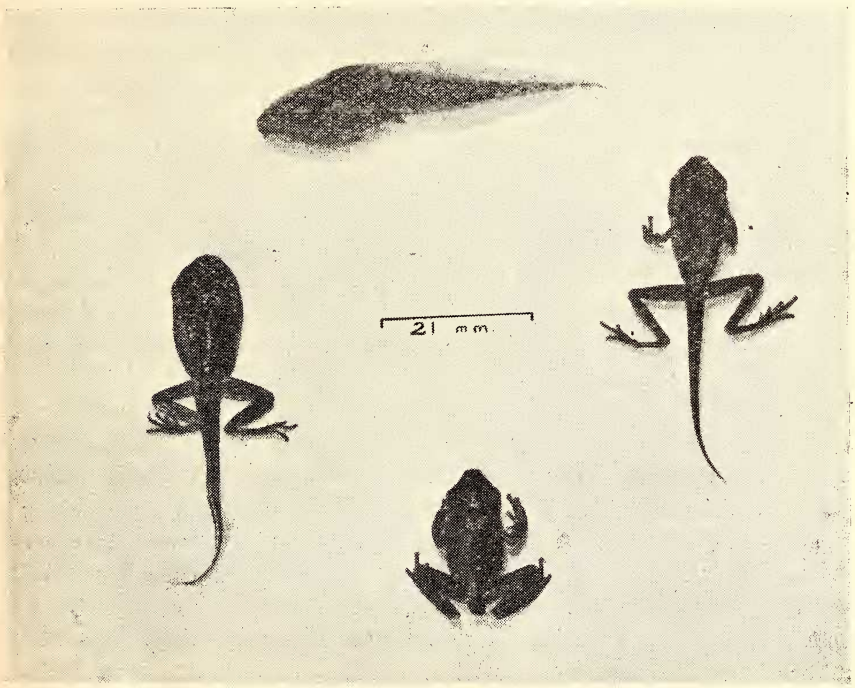
3. Nest on vertical side of rock.

4. Nest opened out to show distribution of eggs.

Photos : A. M. Morgan-Davies

and the male assumed a strained attitude of the abdominal muscles. The ova did not emerge in one sudden gush but slowly, a few at a time, and at short intervals of ten to fifteen seconds. During these intervals the female kept up a steady fanning motion with her feet which distributed the eggs amongst the foam that was slowly increasing in volume. At the same time the male worked his feet slowly up-and-down from his cloaca, past that of the female, and into the centre of the frothy mass. By 10.30 p.m. the frothy mass was a pale pink-fawn colour and about two and a half inches in diameter and the ova were expelled at slower intervals, the frothy mass becoming considerably more tacky. The female grew more exhausted and her breathing more laboured; her body had reverted almost to its normal size.

At 10.45 p.m. the male slowly dismounted from the female who had ceased depositing her ova. The colour of the frothy mass was still a pink-fawn but of a very slightly darker hue on the outside; the



Four stages in the development of *Rhacophorus c. cruciger* (Blyth)

centre, however, was still white. Three minutes after the male dismounted the female slowly moved away from the nest which was then three to four inches in diameter and covering her feet and part of her shanks. Ten minutes later she had parted from the nest and was

obviously extremely exhausted with the effort of making her nest and extracting herself from the mass of foam which had become extremely tacky and disinclined to come away from between her legs. Twelve hours later the coloration of the nest had changed to a pale blue-green.

Discussion on Breeding and Nest-construction

Rhacophorus cruciger is gregarious in its breeding areas. As many as nine nests were found within an area of fifty square feet, whilst outside of this area, although suitable for breeding and nest making, none was found. The majority of nests were constructed on the vertical sides of rocks, two to three feet above water level. A few were found up to thirty feet high amongst the terminal foliage of trees overhanging water, a few others attached to small sedge just above or at water level. In all instances the nests were made overhanging still water.

There is no doubt that it is the female alone who is responsible for the production of the foam nest. To prove this a single gravid female was placed by herself in a cage and that night a fully constructed foam nest with eggs was made.

The foam is formed from the sticky colourless liquid emitted by the female during ova deposition and which is slowly agitated into a frothy mass by a sideways pendulum motion of the feet of the female from the heels. The reason for the movement of the feet of the male is uncertain; its likely object is to prevent the foam from spreading in an upwards direction engulfing the feet of both sexes and thereby making it increasingly difficult for them finally to extract themselves from their viscous egg mass.

Immediately after construction the nests are from two and a half to three and a half inches in diameter and either a pale blue-green or light fawn in colour. Their weight is approximately 350 to 500 grains, but fluctuates according to weather conditions and age.

Plate II (4) depicts an opened-out nest twelve hours old. A centre and an outer layer can clearly be seen; the former is still tacky and contains the majority of ova, the latter is comparatively dry with an outer crust which is brittle and parchment-like, although this may not be quite the case if the nest is exposed to incessant rain and a damp atmosphere.

From a count of ova in six nests it would appear that the number of ova in each nest may vary from 240 to 300 which represents the whole complement of each female. The average diameter of the ova is 2 mm. with a maximum and minimum diameter of 2.4 and 1.8 mm. $\pm$ 0.10 mm. Their colour is a pale cream throughout.